VIRTUAL FENCE DESIGN

Spring 2019 Snapshot Day #1

Team: Shock 'Em

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OBJECTIVE

- This project aims to design a system that can locate and identify rangeland cattle without using GPS, and can create a virtual fence using visuals, a noise and a shock to train the cow where the barrier is.

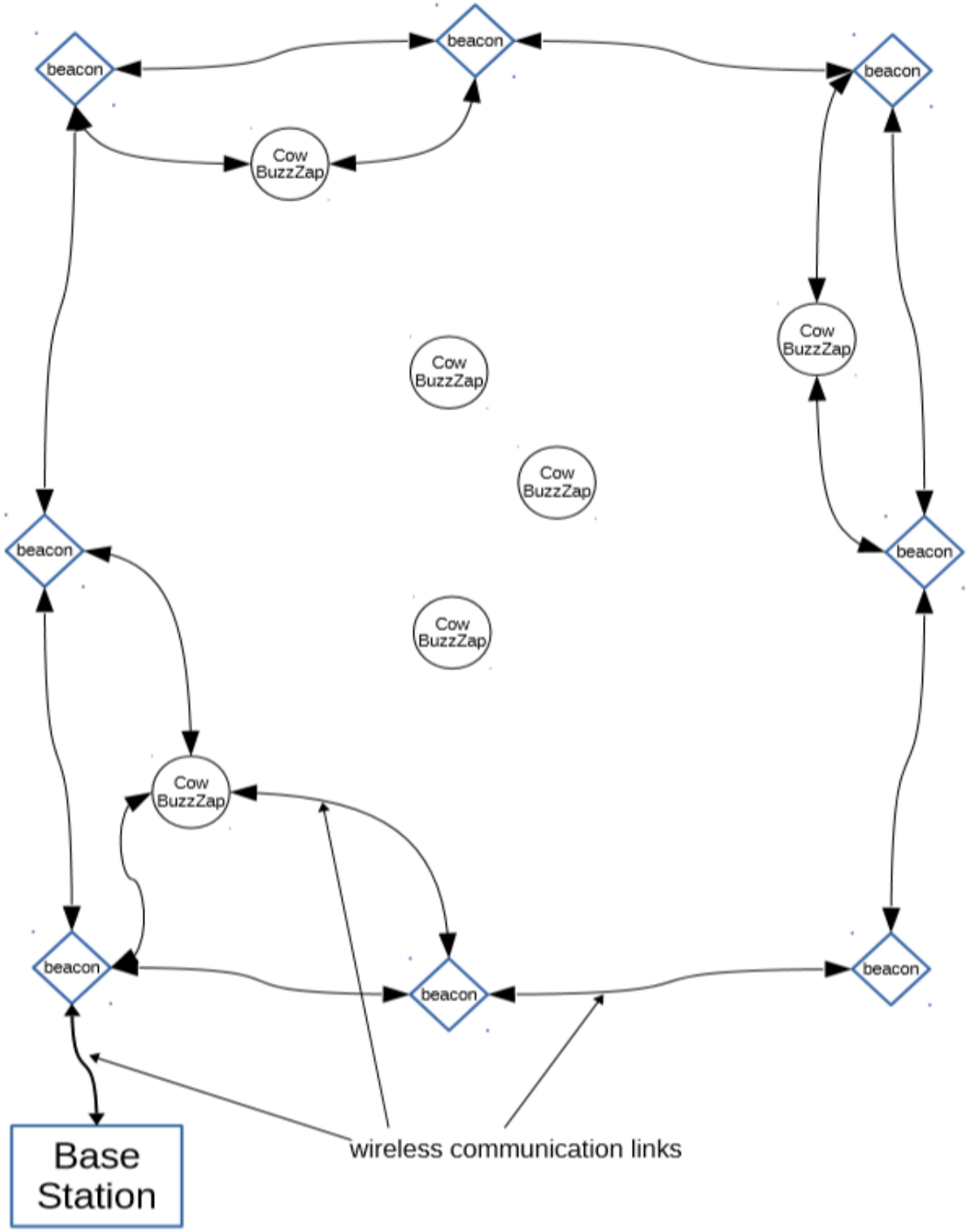
VALUE PROPOSITION/IMPORTANCE

- There are currently no systems that create a virtual fence for rangeland cattle farmers without using GPS. This project aims to design a virtual fence system that is lightweight and more reliable. The system will provide farmers an easy interface to use to locate and identify their cattle, as well as keep their cattle in their property without using fencing, which can cause many problems.

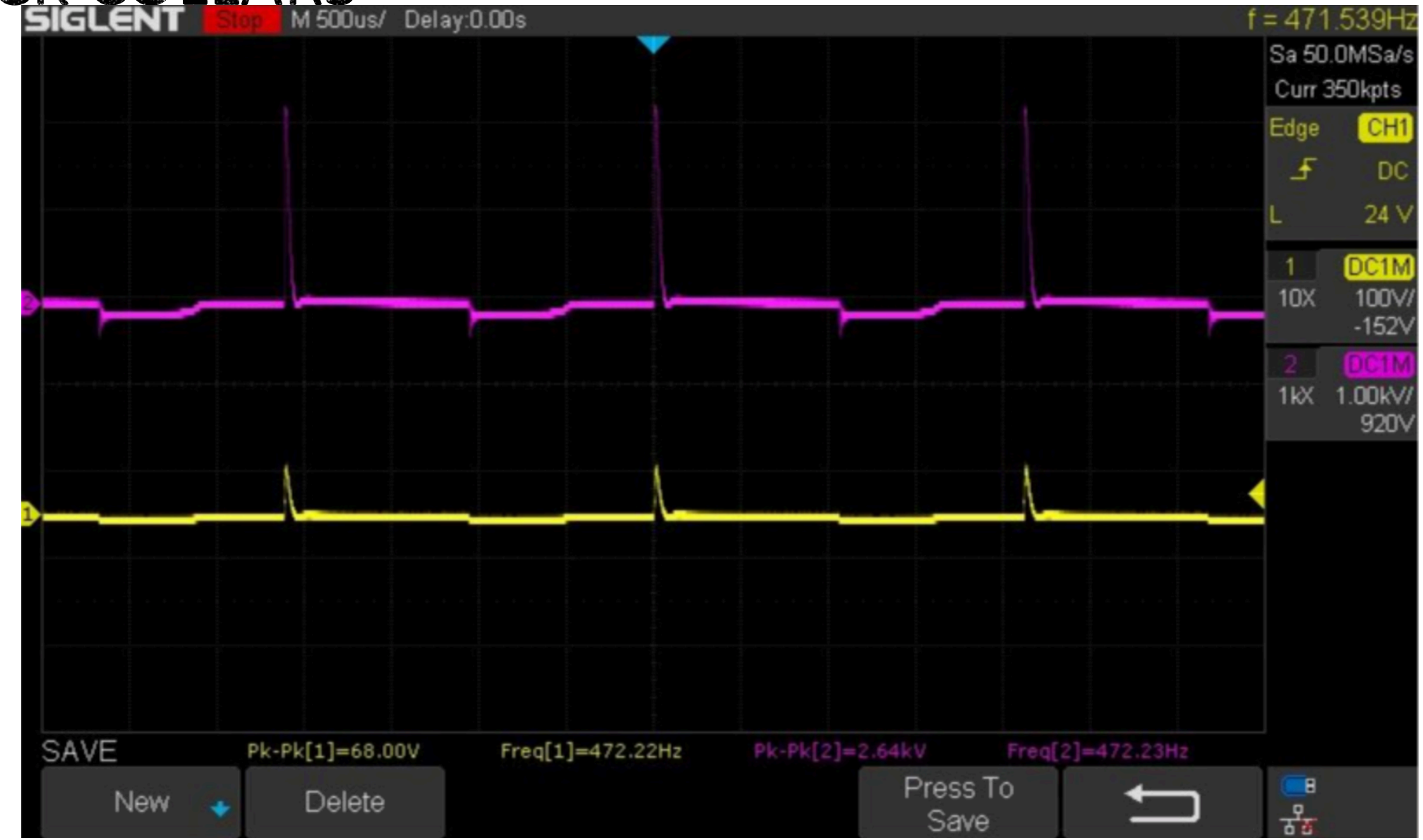
CUSTOMER NEEDS/ DESIGN GOALS

- Reliable
  - Lasts for around 6 months before charging
- Accurate Location Detection Without GPS
- The system can be used to train cattle
  - User can change the timing between the sound and shock
  - User may be able to use the system for other needs with small modifications
- Correct Shock voltage (around 4000V) and buzz noise to train the cattle using a low power circuit
- Lightweight mechanical design for cow tags and beacons

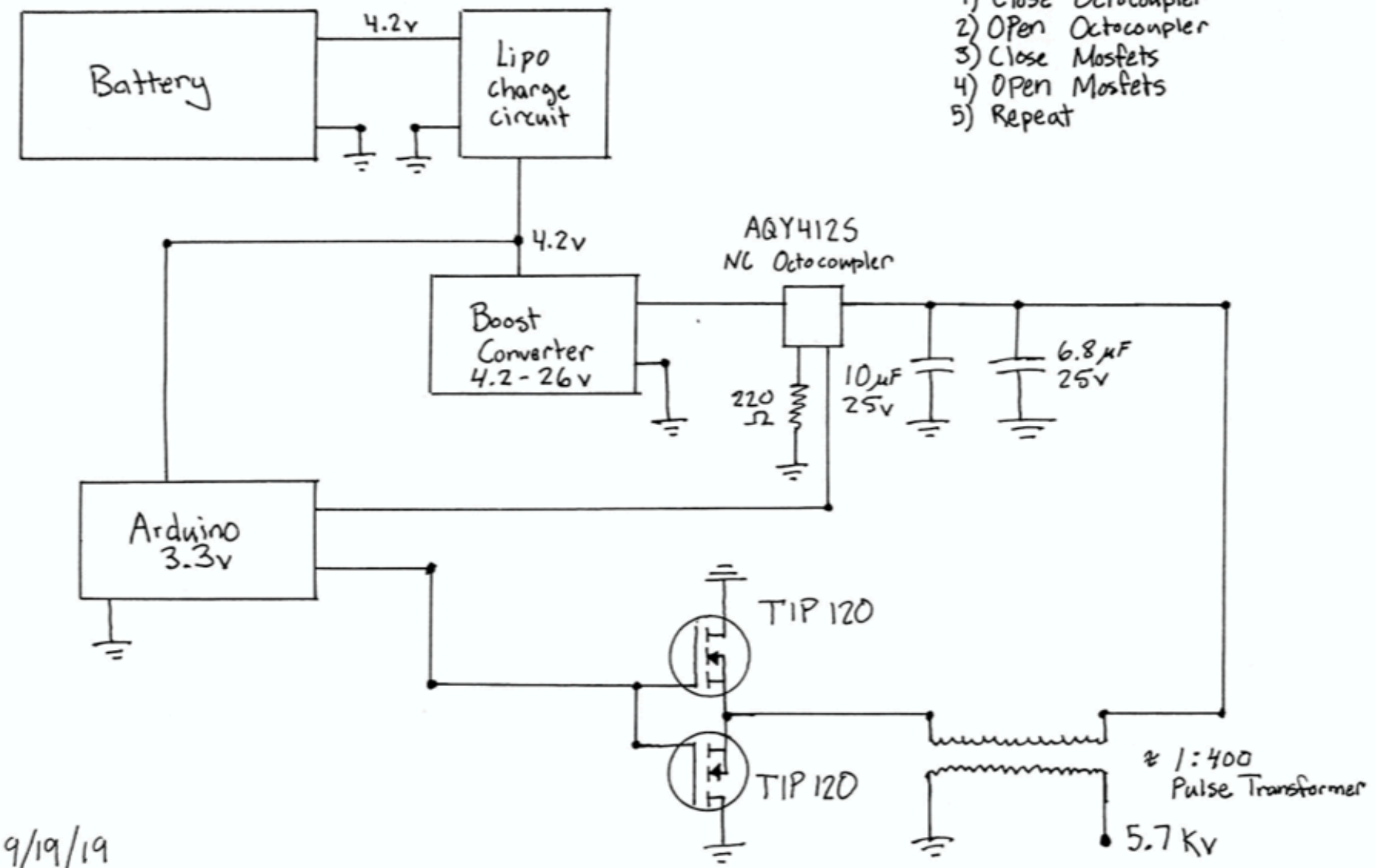
SYSTEM DIAGRA



OSCILLOSCOPE MEASUREMENTS OF EXISTING DOG SHOCK COLLARS



High Voltage, NO radio or Buzzer

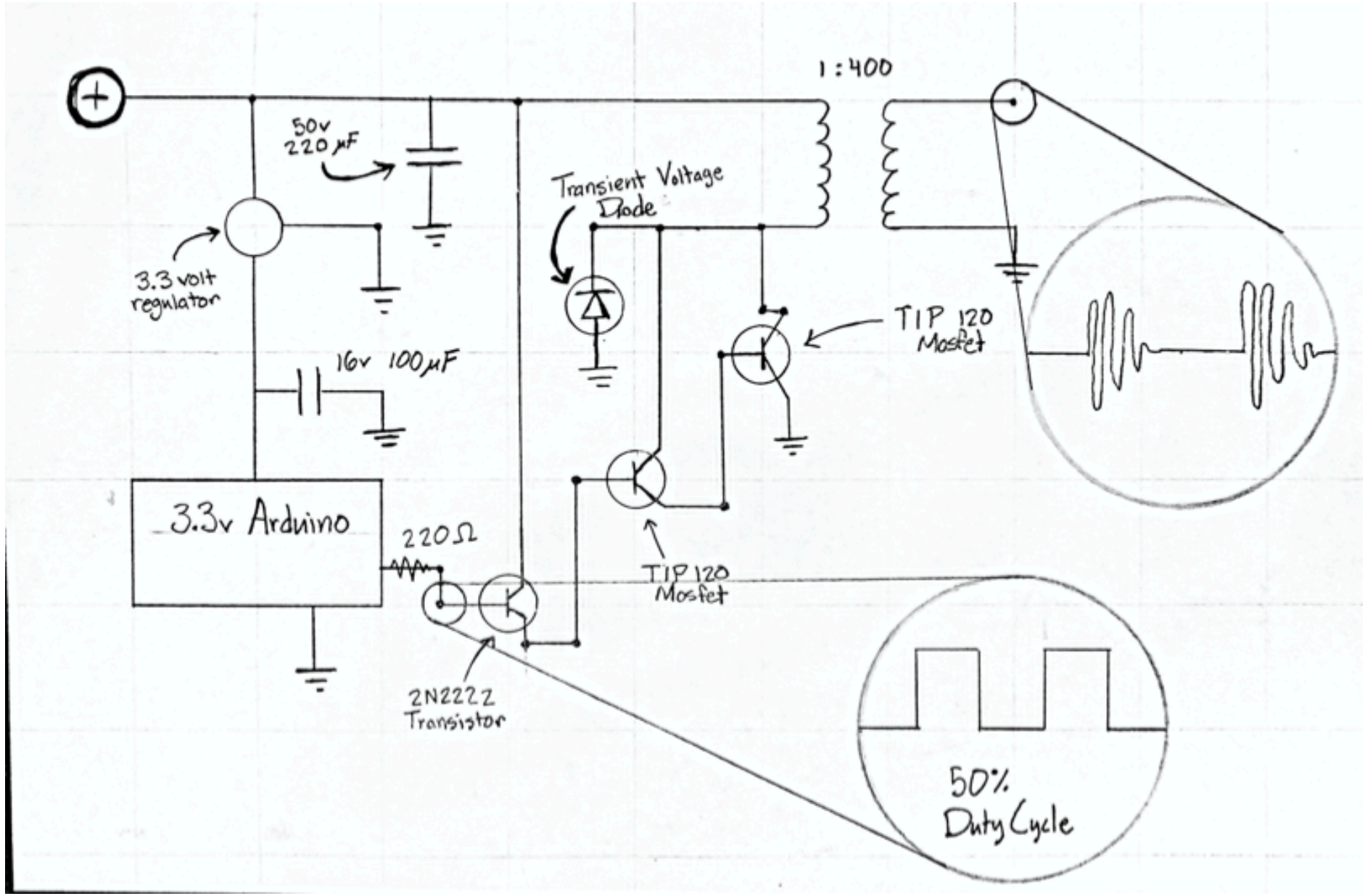


Coding

1) Close Octocompler
2) Open Octocompler
3) Close Mosfets
4) Open Mosfets
5) Repeat

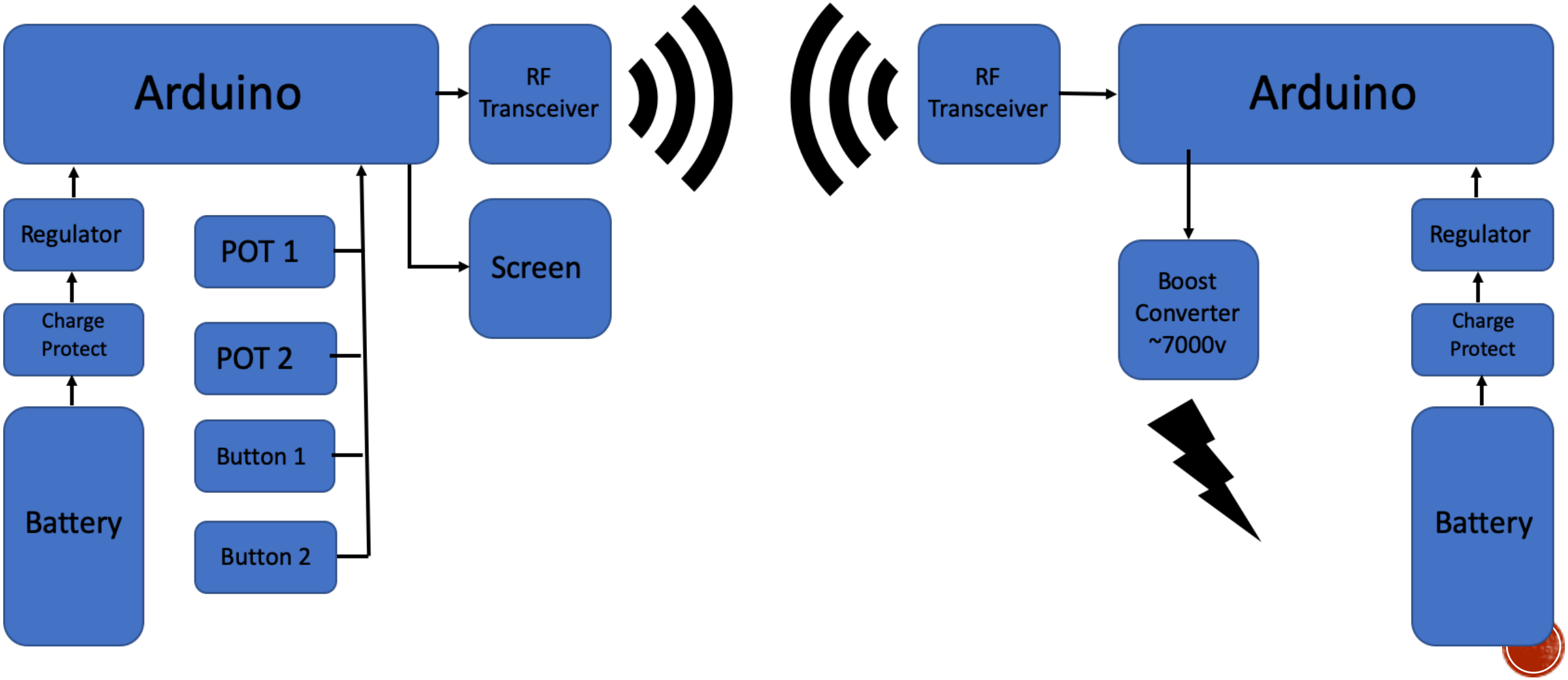
9/19/19
AG

SHOCK CIRCUIT SCHEMATIC (VERSION 1)



SHOCK CIRCUIT SCHEMATIC (VERSION 2)

FUNCTIONAL BLOCK DIAGRAM



MEASURE METHODS

ZigBee is a highly reliable wireless data transmission network,ZigBee data transmission module is similar to mobile network base station.
ZigBee is a wireless connection that can work in three frequency bands: 2.4GHz (global popular), 868MHz (European popular) and 915 MHz (American popular). Its transmission distance is in the range of 10 ≤ 75m, but it can continue to increase. Compared with other methods,ZigBee has the following characteristics:

	Zigbee ✓	Wifi ☒	GPS ☒
Advantages	(1) Low power consumption (2) low cost (3) short delay (4) the network capacity is large (5) Reliability (6) Security (7) Communication (8) I/O	(1) realize signal localization quickly (2) positioning accuracy is higher (3) low cost	(1) Fast (2) high precision (3) can be used without network.
Disadvantages	(1) If a large number of nodes are required, the cost is high (2) the derivative ability is weak, and the ability to penetrate the wall is weak.	(1) Must be in a networked state (2) some environmental construction is difficult	(1) first connection time is too long (2) Will be affected by obstructions

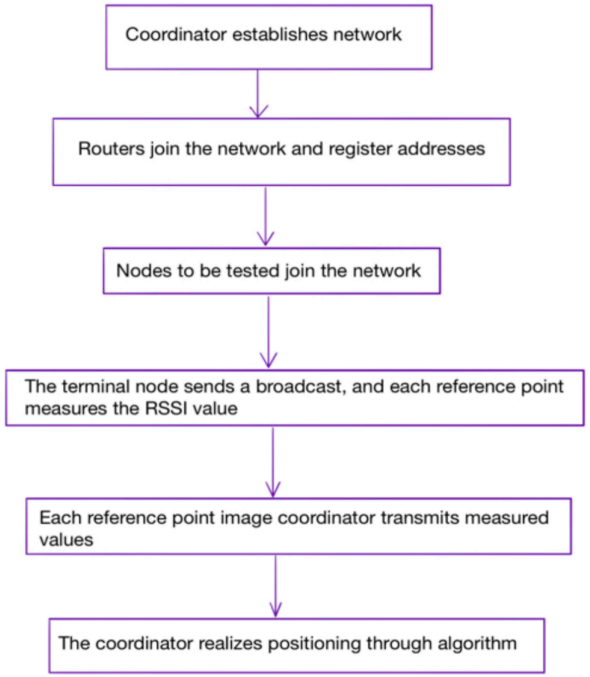
Bluetooth ☒	Infrared positioning ☒	Ultrasonic positioning ☒
(1) Low power consumption (2) has high-performance wireless transceiver system (3) low cost	High indoor positioning accuracy	highly accurate
Mainly used for small-scale positioning, The accuracy is only 3 m~15 m.	(1) The infrared radiation distance is short (2) Cannot cross the obstacle	(1) difficult to overcome multi path-effect and non-line-of-sight effects (2) cost is high.

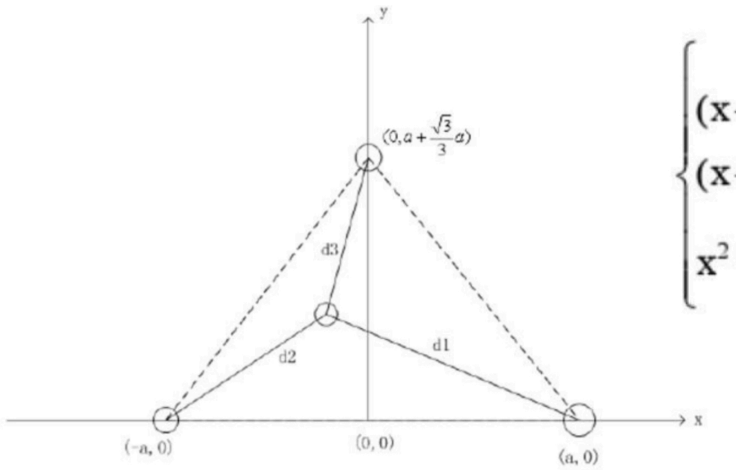
LOCATION DETECTION

After receiving the numerical value on demand of each router, the coordinator adopts the mode management value of the address lookup table, and the numerical value is obtained by using

$$d = 10^{((|RSSI|-a)/(10*n))}$$

the coordinate of the measuring point to be measured is obtained by the Trilateral location algorithm.





$$\begin{cases} (x-a)^2 + y^2 = d_1^2 \\ (x+a)^2 + y^2 = d_2^2 \\ x^2 + (y-a-\frac{\sqrt{3}}{3}a)^2 = d_3^2 \end{cases} \Rightarrow \begin{cases} x = \frac{d_2^2 - d_1^2}{4a} \\ y = \frac{\frac{d_2^2 + d_1^2}{2} - d_3^2 + \frac{1+2\sqrt{3}}{3}a^2}{2(1+\frac{\sqrt{3}}{3})a} \end{cases}$$

SCHEDULE

Capstone Project Schedule - Fall-Spring

Team Shock 'Em **Project:** **Virtual Fence Design**

Last Updated: 10/8/19

		Year	2019																2020																									
		Month	Sept				Oct					Nov				Dec				Jan					Feb				Mar				Apr				May							
Task Description	Duration	Assigned	9/5	9/12	9/19	9/26	10/3	10/10	10/17	10/24	10/31	11/7	11/14	11/21	11/28	12/5	12/12	12/19	12/26	1/2	1/9	1/16	1/23	1/30	2/6	2/13	2/20	2/27	3/5	3/12	3/19	3/26	4/2	4/9	4/16	4/23	4/30	5/7	5/14	5/21	5/28
Client Interview	1 Meeting	12-Sep		x																																							
Weekly Meetings	All Year	Every Thur	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						x	x	x	x	x	x	x	x	x	x	x	x	x						
Create Budget	1 Meeting	19-Sep			x																																					
Product Requirements	1 Meeting	12-Sep		x																																						
Simulate Shock Circuit/Order Parts	2 weeks	10-Oct						x	x																																	
First Snapshot Day	1 Day	15-Oct						x																																		
Visit Rangeland	1 day	17-Oct							x																																	
Test Prototype of Shock Circuit/Nanotron I	1 week	17-Oct							x	x																																
Design Validation Plan	1 day	24-Oct								x																																
Simulate Buzz Circuit/Order Parts	2 weeks	24-Oct								x																																
Project Value Propisition	1 Day	31-Oct									x																															
WikiPage Draft Due	1 Day	7-Nov										x																														
Prototype of Shock/Buzz/Location Circuit	3 weeks	14-Nov											x	x	x																											
Finish code to determine location of cattle	3 weeks	21-Nov												x	x	x																										
Concept Design Review	1 Day	21-Nov												x																												
Snapshot Day #2	1 Day	3-Dec														x																										
End of Semester 1 - Submit Deliverables	1 Day	13-Dec															x																									
Semester 2 - First Meeting	1 Day	23-Jan																					x																			
Finish code/integration of circuits	3 weeks	23-Jan																					x	x	x																	
Design Beacons	3 weeks	6-Feb																							x	x	x															
Engineering Release Review Due	1 Day	21-Feb																									x															
Design shell of device to place on cow	3 weeks	20-Feb																									x	x	x													
Snapshot Day #3	1 Day	10-Mar																												x											
Finish/Polish Deliverables	6 weeks	19-Mar																													x	x	x	x	x	x					
Design Expo	1 Day	1-May																																			x					


WHITE RIM